ISPP INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

PROMOTING WORLD-WIDE PLANT HEALTH AND FOOD SECURITY

INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

ISPP NEWSLETTER

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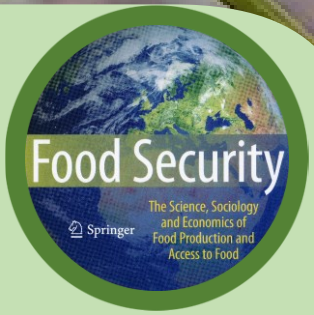

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FIFTEENTH UPDATE ON ISPP RESILIENCE BURSARY FOR PLANT PATHOLOGISTS

VALENTYNA DYSHKO, MAŁGORZATA JĘDRYCZKA, MAŁGORZATA MAŃKA AND GREG JOHNSON

Around the world people often comment how it is just one or two sleeps until an important event. Well, if the ISPP Newsletter was a 'sleep' then with Newsletter we are just one more 'sleep' away from the International Congress of Plant Pathology in Lyon France The program planned is both extensive and thrilling (www.icpp2023.org/programme)!

Elsewhere in this Newsletter you can read about #ICPP_by_bike, an initiative of 20 keen eco-conscious colleagues who are riding by bicycle from Avignon over 250 Km to ICPP in Lyon. Perhaps the "Tour de Phytopath" will rival the Tour de France!

We write this update still reeling from the events in Russia of last weekend but in this update we wish to remind readers about the Concurrent Session C1.7 on Monday 21 August at ICPP2023 - Impacts of war and conflicts in plant pathology research and food safety of countries. Co-chaired by Jean-Jacques Herve (Paris, France) and Alex Shevchenko (Kiev, Ukraine), the delegates will share the perspectives of six speakers on topics linked to present and past conflicts in Ukraine, Rwanda and Burundi and Syria. Hope to see many of you there!

This month we hear from Valentyna Dyshko of the Ukrainian Research Institute of Forestry and Agroforestry, Kharkiv.

VALENTYNA DYSHKO

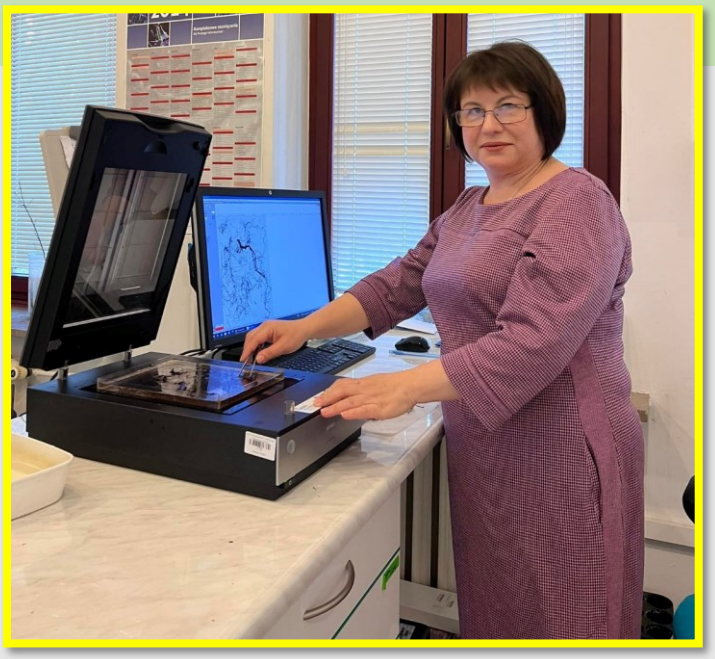
I have 23 years of experience at the Ukrainian Research Institute of Forestry and Agroforestry (URIFFM), named after G.G.M. Vysotsky (Kharkiv, Ukraine). During this time I worked my way up from forest engineer to senior researcher in phytopathology in the Department of Entomology, Phytopathology and Physiology. I have a PhD in agriculture with specialisation in forestry crops and phyto-recultivation. Most of my scientific experience has been spent studying the problems associated with pine resistance to root rot caused by *Heterobasidion annosum*.

After the beginning of Russia's armed aggression in Ukraine, my family was forced to seek refuge outside the Kharkiv region and my scientific work became impossible. Thank you to my colleagues at the Forestry Institute of Poland, I was able to continue my scientific work.

In June 2023, I received a grant from the International Society of Plant Pathology (ISPP) and the Polish Phytopathological Society (PTFit) and can work under the supervision of Professor Tomasz Oszako in the Department of Forest Protection at the Institute of Forest Research (IBL) in Sękocin Stary (near Warsaw).

A group of scientists led by Professor Oszako is conducting research that is partly related to my research in Ukraine.

During the stay, I got to know the methods used in the Panel's Polish research and mastered new tools that enable more efficient research, evaluation of analytical data and solving problems related to forest diseases.



(Left) Dr Valentyna Dyshko scanning the roots of 2-year-old beech seedlings to assess possible damage to the fine roots. The plants were exposed to water stress and some of them received foliar treatment with the silicon preparation OPTYSIL MICRO in different doses. The water scanner and the WinRhizo software help to understand the protective role of silicon (Si).

An important area of research is the study of the structure of microorganisms in the soil and the evaluation of their impact on the safety and sustainability of forest plantations. This area is particularly important in light of recent events in Ukraine. After the explosion of the Kakhovka hydroelectric power plant, part of the soil, including forest soil, is damaged and needs to be remediated. Under the leadership of Professor Oszako, measures have been developed and researched that can help restore biodiversity and the damaged soil.

During my stay at the IBL, I am going to summarise the results of research on 20 annual Scots pine variety testing for resistance to root rot. These descendants are presented by offspring of clonal seed orchards (CSOs) from three regions of Ukraine (Volyn, Kyiv and Kharkiv regions). The comprehensive assessment of the offspring of CSOs, taking into account the resistance to the annosum root rot, will identify the most promising among them to cultivate in local conditions.

Dr Valentyna Dyshko, Senior Researcher at (Right) URIFFM (Kharkiv, Ukraine) in the Białowieża Forest (Białowieski Park Narodowy) looking for *Pinus sylvestris* trees infested with *Heterobasidion annosum*. Core samples of withered and viable trees were taken with a Pressler drill to determine the differences between them with an electronic nose.

Our collaboration offers the opportunity to develop recommendations for restoring degraded land that will be useful not only in Poland but also in Ukraine. Our cooperation will lead to joint publications in high-ranking international journals and projects. I look forward to continued close international cooperation on forest restoration in Ukraine.

Above - From left: Dr. Ireneusz Olejarski (Department of Forest Ecology, IBL, Poland), Dr. Valentyna Dyshko (Department of Entomology, Phytopathology and Physiology, URIFFM, Ukraine) and Prof. Dr. Tomasz Oszako (Department of Forest Protection, IBL, Poland) during the discussion in the IBL greenhouse. Satisfied faces show that the results of treating the plants with the silicon preparation were positive. The foliar treatment helped beech seedlings survive the simulated drought, probably due to better water management. The efficiency of photosynthesis increased and the expression of genes (Hot Shock Proteins - HSP) was shown to be based on natural resistance processes.

I would like to thank the management of the Polish Forest Research Institute for providing me with free accommodation and all my colleagues who helped me at this difficult moment in my life.

ICPP2023 BY BICYCLE

CINDY MORRIS AND GREG JOHNSON

#ICPP_by_bike is a collective of about 20 scientists who strongly believe in facilitating biking as a means of personal and professional transportation – at all scales. From our homes and research institutes in Avignon, Montpellier and Bordeaux in France, Milan in Italy, Stratford-upon-Avon in the UK and Columbus, Ohio in the USA we will set out together for the ICPP-2023 conference in Lyon along the ViaRhôna (https://en.viarhona.com/) bike path starting from the legendary Pont Saint Bénezet bridge in Avignon. The main goals of the #ICPP_by_bike collective are to raise awareness about the carbon footprint of our professional and personal activities and to confront a biking challenge that can reveal obstacles to reducing our footprints. These goals are part of growing initiatives concerning environmental and social reasonability of our behaviors as citizens and professionals that include diverse actions ranging from reducing the use of pesticides in agriculture to fostering social and economic justice. To achieve our goal of biking for three days for a total of >250 km together in the August heat of southern France, we have spent several months building a cohesive team founded on a sense of solidarity. We would like to extend this solidarity to scientists qualifying for the ISPP Resilience Bursary. Please donate to the ISPP Resilience bursary in recognition of the kilometers we will pedal. Click the PayPal Button or use the QR Code to Donate.

PayPal™ Donate Now

For more information about #ICPP_by_bike contact cindy.morris@inrae.fr

The International Society for Plant Pathology (ISPP) (@Food_Security) established a "Resilience Bursary for Plant Pathologists" in 2022. ISPP contributed to and received funds from other plant pathology Societies and individuals to support emergency/refugee situations, specifically for plant pathologists. Currently the fund has supported about 13 refugee scientists from Ukraine through support for placements in Polish Research Agencies co-ordinated by the Polish Phytopathological Society. We are also liaising with the Turkish Society of Plant Pathology and the Arab Society for Plant Protection and the American Phytopathological Society (APS) Office of International Programs (OIP), to support students affected by the 2023 earthquake in Turkiye and Syria. For more information or questions about donations, contact resilience@isppweb.org. To keep up on news about the ISPP Resilience Bursary, subscribe to the ISPP Newsletter (It's free) https://www.isppweb.org/newsletters/search_volume.html

Fourth Reminder - Please Complete our Survey on Plant Pathology in the Social Media Age

GREG JOHNSON AND ANDREA MASINO

Thanks to the 200 additional respondents to our survey in June! Analysis of survey data will be finalised in July for our ICPP2023 presentation. However, we will keep the survey open until after the Congress so we might obtain responses from some of the 2000 + Congress delegates! So far we have received 700 + responses. We're hoping for 1000 responses so, if you haven't already, please help us by completing it now and please add your views in the comments section!.

At ICPP2023 and in our reports via the ISPP newsletter, survey findings will be summarised under:

(a) topics most important to social media readership
(b) platforms respondents use to access plant pathology related topics and inspiration
(c) scientific societies and other sources of plant pathology information, and
(d) the demographic profiles of users and non-users.

The Green Button below has the link to the survey.

CLICK HERE TO PARTICIPATE IN THE SURVEY!

ICPP2023 Programme is out

With now less than 50 days until the ICPP2023 in Lyon, France, the time has come to plan which presentations, workshops and posters to attend. The programme is now fully uploaded on the website. The programme also includes all abstracts of accepted posters.

NEW SENSOR CHIP ADVANCES RAPID, COST-EFFECTIVE DISEASE DIAGNOSTICS

GABE SALDANA, AGRILIFE TODAY, 20 JUNE 2023

Texas A&M AgriLife Research scientists and collaborators at Iowa State University have developed a sensor chip that can detect many disease pathogens with 10 times the sensitivity of currently available methods. The chip also eliminates the need for chemical dye reagents typically used in the diagnostic process. The new technology shows promise for rapid, low-cost point-of-care diagnostic capabilities in plants, foods, animals and humans, including detecting foodborne pathogens, bird flu and COVID-19. Results from the new sensor are available in about 30 minutes.

In their research, published in ASC Sensors, scientists used the new sensor to detect *Phytophthora infestans*. The pathogen causes globally devastating late blight disease — a particular threat to potato and tomato crops.

The research was co-led by Jinping Zhao, Ph.D., AgriLife Research postdoctoral research scientist in Dallas, and Subin Mao, a Ph.D. candidate in electrical and computer engineering at Iowa State University. Serving as corresponding authors were collaborators Junqi Song, Ph.D., associate professor and plant immunity research lead with AgriLife Research in Dallas, and Long Que, Ph.D., professor of electrical engineering at Iowa State University. Seed grants from each university funded the research.

BUILDING ON EXISTING TECHNOLOGIES

The new sensor improves upon a technique known as loop-mediated isothermal amplification, or LAMP, which is widely used to detect pathogens by amplifying their DNA. Detection of LAMP products amplified from templates, such as pathogen DNA, often requires that the products be "labeled" by using fluorescence dyes — a costly process with low sensitivity. The new sensor diagnoses pathogens without such reagents and at high sensitivity. It also eliminates a lengthy DNA purification process that creates challenges for point-of-care use.

The new chip consists of a nanopore thin-film sensor inside a special reaction chamber. Primers are uniquely designed to be immobilised on the nanofilm, causing amplified LAMP products to become bound to the sensor, which produces signals that can be directly and easily measured with a portable spectrometer.

WHAT'S NEXT

The LAMP chip offers a new portable platform to detect pathogens using label-free sensors with ultrasensitivity. The research team will now work to further enhance sensitivity to a subattomolar or even lower level.

The team aims to offset current challenges to detecting and distinguishing pathogen species and strains with high-sequence similarities. They will also work to improve the specificity of detections and establish quantitative detection by integrating artificial intelligence and CRISPR gene-editing technologies. Their goal is to achieve a viable product for broad adoption in plant, animal and human health point-of-care applications.

SUGAR CANE RESEARCHER, ROBERT MAGAREY, WINS AWARD FOR EXCELLENCE IN AGRICULTURAL RESEARCH

CHRISTINE WALKER, SUGAR RESEARCH AUSTRALIA NEWS, 21 JUNE 2023

Sugar Research Australia Chief Executive Officer Roslyn Baker congratulated plant pathologist Dr Robert Magarey for winning the 2023 Award for Excellence in Agricultural Research.

"Rob has worked in sugarcane pathology for the sugar industry for more than 40 years, predominantly in the Tully area. He is currently SRA's leader for disease management and is tackling such serious diseases as ratoon stunting disease (RSD) which costs the industry an estimated $25 million in lost yield annually," Roslyn Baker said.

"He is strongly focused on continuing to develop appropriate management strategies to protect growers and the industry from real and potential biosecurity risks."

"An exciting breakthrough in recent years has been Rob's work with The University of Queensland to develop an RSD test where the disease can be detected in sugarcane juice at the mill. The new test will mean that it will be possible to identify not only the amount of sugar in a juice sample but also any RSD, backed-up by accurate records of the variety and the location where the cane is grown. From this it will be possible to put together a district RSD map, providing for targeted extension and management."

"The technology looks like a simple coffee cup. It has eight testing stations where sucrose and soil contaminants are managed using a dipstick test involving a DNA assay. The test takes about 50 minutes with eight tests running at one time. It could potentially also be used to determine the distribution and spread of other diseases such as chlorotic streak or pests such as moth borers should they ever reach our shores."

Roslyn said that due to the lack of external symptoms, many sugarcane growers did not believe their crops had RSD and put down a loss of yield to weather conditions. "However, we believe some mill areas are losing up to $4 million a year with up to 50 per cent of crops infected."

She said Rob Magarey had played a key role in talking to sugarcane growers face to face at district events about the successful management of RSD on farm. "He is a great communicator who puts difficult science into simple terms; he is easy to approach, very easy to listen to, and to follow up with afterwards with a question or two of your own."

The Award was presented last night at the Kondinin Group and ABC Rural 2023 Australian Farmer of the Year Awards at Parliament House, Canberra.

MYCORRHIZAL FUNGI HOLD CO_2 EQUIVALENT TO A THIRD OF GLOBAL FOSSIL FUEL EMISSIONS

LIZ KIMBROUGH, MONGABAY 13 JUNE 2023

- A recent study estimates that more than 13 billion metric tons of CO_2 from terrestrial plants are passed on to mycorrhizal fungi each year, equivalent to about 36% of global fossil fuel emissions.
- The study highlights the overlooked role of mycorrhizal fungi in storing and transporting carbon underground through their extensive fungal networks
- Researchers analysed nearly 200 data sets from various studies that traced carbon flow and found that plants allocate between 1% and 13% of their carbon to mycorrhizal fungi.
- Understanding the role of mycorrhizal fungi is essential for conservation and restoration efforts, as soil degradation and the disruption of soil communities pose significant threats to ecosystems and plant productivity.

Plants and fungi struck a deal way back when. More than 400 million years ago, plants began trading sugar made from sunlight (a.k.a. carbon) for some of the soil nutrients gathered by mycorrhizal fungi. Nearly 90% of all land plants are now part of this arrangement, so scientists estimated that the amounts of carbon flowing through underground fungi must be significant. However, they didn't realise how much carbon was in the system until now.

According to a recently published study in *Current Biology*, more than 13 billion metric tons of CO_2 is passed from plants to mycorrhizal fungi each year — equivalent to around 36% of all annual global fossil fuel emissions.

"We always suspected that we may have been overlooking a major carbon pool," said study co-author Heidi Hawkins, research lead at Conservation South Africa and research associate on plant-soil-microbe interactions at the University of Cape Town.

"Understandably, much focus has been placed on protecting and restoring forests as a natural way to mitigate climate change," Hawkins said. "But little attention has been paid to the fate of the vast amounts of carbon dioxide that are moved from the atmosphere during photosynthesis by those plants and sent belowground to mycorrhizal fungi."

Researchers examined 194 data sets from 61 peer-reviewed papers and four unpublished studies to determine how much carbon plants allocate to fungi. They found that plants pass between 1% and 13% of their carbon to mycorrhizal fungi, depending on the type of fungi. Most of these estimations came from isotope-tracing techniques, which involve labeling carbon and measuring the proportion that becomes part of the fungi.

Read more.

PLANTVILLAGE RECEIVES $4.96 MILLION GRANT TO COMBAT CROP LOSS IN AFRICA

PENN STATE UNIVERSITY NEWS, 16 MAY 2023

The Bill & Melinda Gates Foundation is awarding a $4.96 million grant to Penn State's PlantVillage to help increase food production for smallholder farmers who face pests and disease of their crops across sub-Saharan Africa. The research project, called Delphi, will create a modeling platform that can be used by researchers globally to improve the speed and accuracy of efforts to identify emerging threats.

A Tanzanian cassava farmer, left, learns to use a plant disease mobile app developed as part of the PlantVillage initiative led by Penn State researchers. (Photo credit: Penn State. Creative Commo).

The United Nations Food and Agriculture Organization (FAO) estimates that each year, 20% to 40% of global crop production is lost to plant pests and diseases. The global economic cost of plant diseases alone is estimated to be $220 billion, and invasive insects account for an additional $70 billion in losses.

"The problem is especially challenging for small-sale farmers in sub-Saharan Africa, where there is limited existing capacity to deal with these threats," said David Hughes, founder of PlantVillage and Huck Professor in Global Food Security, Penn State. "For example, smallholder farmers growing maize in East Africa lose billions annually from pests and diseases that ravage their crops."

Hughes noted that researchers anticipate climate change and other factors will lead to an increase in pest and pathogen outbreaks — and absent new efforts to combat the problem, damage to food security and economic livelihoods in the region will intensify.

Outbreaks extend across national boundaries, and response must involve regional efforts focused on timely information sharing, surveillance and control, he added. That requires maintaining plant health systems that can efficiently use limited resources via better coordination and innovation.

Key beneficiaries of this investment will include international organisations, like the CGIAR global network of agricultural research centers and FAO, and researchers at local universities and in the private sector. It will help them develop computer vision and machine learning models that can identify, track and predict pest outbreaks. PlantVillage has been a pioneer in the development and deployment of computer vision models that accurately and precisely diagnose crop diseases. This builds upon extensive FAO collaborations, including the eLocust3m mobile app that helped halt the 2020 African Locust plague, and the Fall Armyworm Early Warning system, both built by PlantVillage.

PlantVillage employs two different modelling approaches in all its work. One is developing a platform on which the scientific community can train, validate and deploy machine learning models to detect crop diseases or pests using smartphones. The other uses statistical and machine learning models to translate geographically separated pest and disease observations into usable maps predicting pest presence.

"The goal of Delphi is to develop new models that can detect the dynamics of emerging threats in weeks rather than months," Hughes said. "The ability to allow a user to provide feedback from the field, using a smartphone camera, will ensure that the model predictions are accurate."

These data will be used by all stakeholders to manage emerging issues, identify priority areas, and develop early warning systems, he explained.

The project complements related work ongoing through initiatives such as the USAID Feed the Future Innovation Lab for Current and Emerging Threats to Crops, which was awarded to Penn State; the CGIAR's Plant Health Initiative; and the Malawi Digital Plant Health Service with National Public Ownership. It can support efforts to develop a collaborative system that meets regional needs for prediction and response to transboundary pests.

The work also continues the long-term association between Penn State and FAO, which stretches back to 2018 when Hughes was an FAO Fellow in Rome working with the Desert Locust and transboundary pest group, led by Keith Cressman.

"It is really rewarding to see this project funded," said Cressman. "It's a strong statement that leveraging digital technologies and working in partnership across institutions like FAO and Penn State pays great dividends."

Huck Institutes Director Andrew Read said, "The PlantVillage team continues to meet the global challenge of food security by refining and building upon the ingenious systems they have created. I can't think of a more inspirational example of a Huck project than this one, both in terms of bringing disparate disciplines together and in making a powerful impact on a global scale."

Prasanna Boddupalli, CGIAR Plant Health Initiative lead, said, "The PlantVillage platform has excellent complementarity with the efforts being made under the CGIAR Plant Health Initiative with partners in sub-Saharan Africa, Asia and Latin America. The project offers promise in terms of more effective pest and pathogen diagnostics using artificial intelligence and deep learning. It can potentially build the capacities of a new generation of scientists and students in the Global South on plant health management using modern tools and approaches."

Angela Records, USAID Bureau for Resilience and Food Security Research Operations and Implementation lead, said, "We cannot achieve Feed the Future goals of agriculture-led economic growth, strengthened resilience, and a well-nourished population without addressing the often-devastating impacts that pests and pathogens have on crops around the world. Recognising this, USAID is partnering with Penn State through the Current and Emerging Threats to Crops Innovation Lab and leveraging the PlantVillage platform to monitor transboundary pests and diseases and provide critical threat information to farmers and other decisionmakers."

UNSUSTAINABLE COFFEE PRODUCTION IS MAKING MORE AND MORE PEOPLE SICK

UNIVERSITY OF COPENHAGEN NEWS, 8 JUNE 2023

Intensive pesticide use on coffee farms around the world is leading to progressively more reports of poor human and animal health. Coffee production needs to return to its roots and rediscover sustainability, according to a University of Copenhagen researcher who led a comprehensive review of research concerning alternative protection strategies for coffee plants.

The slightly bitter, aromatic and vitalising beverage is a lifestyle and daily ritual for many. Globally, nearly three billion cups of coffee are consumed every day. Unfortunately, coffee production has also become problematic, with negative health impacts on humans and animals now on our conscience.

Coffee plants are subjected to a barrage of attack by insects, bacteria and fungi as a result of their being increasingly grown as a monoculture crop since the 1990's. These attacks may also be exacerbated by climate change. On larger coffee plantations in particular, this has led to the increased use of pesticides, the primary weapons used by farmers to combat unwanted guests.

In Brazil, the world's largest coffee producer and pesticide consumer, chemical pesticide use increased by 190% in a single decade. Estimates show that roughly 38 million kilograms of pesticides are used annually in Brazilian coffee production.

And since 2019, 475 new pesticides have been approved in Brazil. More than a third of these are not approved in the EU due to their toxicity.

"The problem is that there are more and more reports of pesticide contamination in groundwater and ecosystems, and harmful symptoms and disorders among animals and humans in areas where coffee is grown – from skin disorders, respiratory problems, to high blood pressure, organ damage, cancer and cardiovascular disease. All of this seems to be linked to the use of pesticides in coffee production," says Athina Koutouleas, a newly graduated PhD fellow at the University of Copenhagen's Department of Geosciences and Natural Resource Management.

Dr. Koutouleas is the lead author of a meta-study published in the journal *Plant Pathology* that reviews research regarding alternative plant protection strategies for coffee. The study was conducted with Professor David B. Collinge of the Department of Plant and Environmental Sciences and Associate Professor Anders Ræbild of the Department of Geosciences and Natural Resource Management.

"If we want to enjoy our morning coffee in the future, we'll need to stop producing it like there is no tomorrow. Pesticides are effective against pests and plant diseases and can provide coffee farmers with a high yield in the short term. But in the long run, you shoot yourself in the foot by destroying ecosystems and health at large," says Athina Koutouleas.

GETTING COFFEE GROWING BACK TO ITS ROOTS

The researchers point to a variety of strategies as sustainable alternatives to traditional chemicals. One of them is agroforestry – the cultivation of crops and trees on the same land. This method would return coffee growing back to the coffee plant's 'roots'.

"The coffee plant originated thousands of years ago in an environment shaded by a rich array of plants, shrubs and trees in southwestern Ethiopia. This is the traditional way Ethiopian farmers grow coffee. It often has the advantages of minimising pests and diseases while strengthening plant health, biodiversity and ecosystems," says Koutouleas.

Furthermore, agroforestry diversifies a farmer's income revenues as profits can be earned on both the coffee beans and secondary farm products such as wood, livestock feed or fodder and other tropical cash crops such as vanilla or cinnamon.

"The challenge may be that some pests and diseases will tend to thrive in such a system. So, deciding on which combination of plants and trees offers the most value for the farmer and must be carefully planned. For example, should fast-growing banana trees be planted or hardwoods that can be harvested for timber? Thus, the cultivation method must be adapted to local needs. It is no magic bullet, but in my view, it's the most sensible one," says Koutouleas.

The researchers also pointed to expanding the use of biological control where, instead of chemical pesticides, bacteria, fungi and insects are introduced to serve as natural enemies for pathogenic organisms.

The third possible strategy highlighted by the researchers is a new genomic technique called RNA interference. Here, RNA molecules are sprayed onto a crop, which then turn off vital genes in the target organism which threatens the coffee plant. One of the primary advantages of the technique is that the substance only affects the targeted pest and is quick to degrade in the environment. This technique has been tested on a number of crops, but not yet on coffee.

THE BIGGEST FARMERS ARE THE BIGGEST PROBLEM

Small-scale farmers cultivate 70-95% of the world's coffee on plots of land that are typically less than five hectares. The vast majority of them do not use pesticides and already engage in agroforestry to one degree or another. The remaining are large-scale farmers, generally located in Brazil and Vietnam, who account for a disproportionate share of global production. Athina Koutouleas claims that the cultivation of coffee by these farmers pose the major problem: "It is this small percentage of coffee farmers who are pushing production in an unsustainable direction by growing coffee as monoculture and using lots of pesticides. But if you degrade the environment in which coffee grows, the very environment which the plant relies on is jeopardized."

Besides investing in research focused on environmentally friendly genomic technology, the researchers recommend that farmers be supported at the national or international level to switch to agroforestry or the other strategies recommended. "Farmers that implement green initiatives should be rewarded through compensation programs. Emphasis should also be on coffee roasters, importers and other links in the value chain with sustainability programmes that actually make a difference to the coffee plant, the environment it is cultivated within and the people who cultivate it," concludes Athina Koutouleas.

DEVELOPING RICE VARIETIES RESISTANT TO A BACTERIAL DISEASE OUTBREAK IN AFRICA

HEINRICH HEINE UNIVERSITY DÜSSELDORF NEWS, 20 JUNE 2023

The "Healthy Crops" international research consortium led by Professor Dr Wolf B. Frommer from Heinrich Heine University Düsseldorf (HHU) is developing disease-resistant rice varieties. In the scientific journal *eLife*, the authors now report on the discovery of a recent bacterial outbreak in Tanzania – and describe how they modified an African rice variety to make it resistant to the pathogen.

Rice field infected with bacterial blight in Dakawa. The wilting and desiccation of the leaves results in significantly reduced yield for the small-scale food producers (Photo credit: Mohammed Mkuya, Rosemary Murori).

Bacterial blight of rice, which is caused by the bacterium *Xanthomonas oryzae* pathovar *oryzae* (Xoo for short), is responsible for devastating crop losses among rice farmers every year. It above all threatens the livelihoods of small-scale farmers in Asia and Africa, and accounts for malnutrition and famine in the affected regions.

Although bacterial blight was not considered a major threat to rice production in Tanzania until now, in 2019 fields were detected in the Morogoro region in east Tanzania that showed in part severe damage by the disease. Subsequent surveys further indicated that the pathogen had already spread to many regions of Tanzania by now. Based on the rapid spread, it is not unlikely that the disease will also migrate to neighbouring countries. To determine the arsenal used by this strain, the pathogen's genome was sequenced. The analysis of the sequences showed that the bacteria are distinct from the native populations in Africa and are highly similar to strains from Asia. Similar to the Asian strains, but different from the African ones, they have one tool that blocks a common rice resistance gene, called iTAL, and they possess a particular set of keys to the plants' pantry. Injection of a regulatory "key" protein, developed by these bacteria, into rice cells turns on the production of a sugar transporter named SWEET11a that leads to the release of sugar in the neighbourhood of the bacteria, which can serve for nutrition and is needed for multiplication and virulence of the bacteria.

According to Dr Boris Szurek, who heads the group involved in the study at the French national research institute for sustainable development (IRD): "Until 2019, strains from Asia were never found in Africa. Similarly, African strains were not found in Asia, pointing to a recent introduction from Asia into Africa, which is now causing yield losses across Tanzania."

Professor Dr Wolf B. Frommer from the Institute of Molecular Physiology at HHU, who heads the international research consortium "Healthy Crops", explains: "To protect African rice production from the emerging threat by the pathogenic bacteria, we have used new breeding techniques to exchange the locks in the popular East African elite variety "Komboka" so that the pathogen's key cannot open the pantry anymore and thus, not cause the disease. The edited lines show broad-spectrum resistance against all known Asian and African strains of Xoo, including the strains recently discovered in Tanzania."

Co-author Professor Dr Bing Yang from the University of Missouri in Columbia, USA adds: "We intend to help African scientists with these discoveries and use new breeding methods to develop locally adapted disease-resistant rice varieties. The knowledge can also be used to inform conventional breeding of varieties resistant to the rapidly spreading strains for those countries that have not yet established regulations for new breeding techniques."

"Healthy Crops" project

Pesticides are often used to combat Xoo, however their effectiveness is limited and they expose the population to risks. The "Healthy Crops" non-profit international research project is taking a different approach, with the aim of breeding and making rice lines available that are resistant to the disease. This is expected to significantly increase yields for small-scale food producers in Africa and Asia.

The project is an international consortium involving scientists from HHU, the University of Florida and University of Missouri in the USA, the International Centre for Tropical Agriculture in Colombia (CIAT), the French national research institute for sustainable development (IRD), the International Rice Research Institute (IRRI) in the Philippines and Kenya, and two institutes of the Indian Council of Agricultural Research (ICAR). The project is led by Professor Wolf B. Frommer, who is based at HHU; Dr Marcel Buchholzer is responsible for coordination of the project in Düsseldorf.

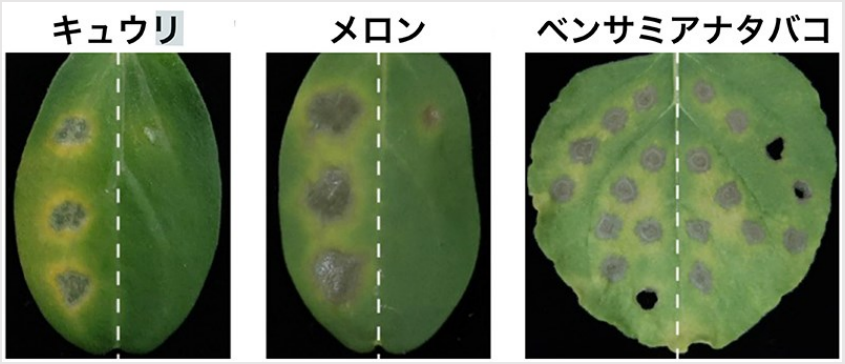
To achieve its goals, the consortium has developed a strategy to combat bacterial blight. The team has already successfully bred disease-resistant rice lines. A diagnostics toolbox has additionally been developed to enable the rapid diagnosis of emerging pathogenic bacterial strains.

Close-up of a rice leaf infected by *Xanthomonas oryzae* pv. *oryzae*. The bacterium migrates through the leaf and causes the typical lesions (Photo credit: Mohammed Mkuya, Rosemary Murori).

SCIENTISTS IDENTIFY FUNGAL PROTEINS RESPONSIBLE FOR SUPPRESSING HOST PLANT IMMUNITY FROM INFECTION

KYOTO UNIVERSITY NEWS, 5 JUNE 2023

While infectious fungal plant diseases relentlessly wreak havoc on many crops, they are also picky when choosing their hosts. Each fungus generally exhibits a specific host range, but the mechanism of this specificity has not been well understood. Kyoto University researchers have now identified and categorised four fungal proteins called effectors responsible for suppressing host plant immunity from infection. The paper "Selective deployment of virulence effectors correlates with host specificity in a fungal plant pathogen" appeared on 20 March 2023 in *New Phytologist*.



Deletion of four genes (EPCI to EPC4) reduced pathogen virulence. From left to right: cucumber host, melon host, and benth host (Photo credit: Kyoto University, Yoshitaka Takano).

Phytopathogens are plant pathogenic fungi that secrete these effectors. As a result, the harmful fungus generally exhibits distinct host specificity when infecting plants, causing more than 70% of plant diseases.

According to the researchers, the four effector proteins named EPC1 to EPC4 in *Colletotrichum orbiculare,* a phytopathogenic fungus, establish specificity on a host cucumber.

"The four effectors have very different amino acid sequences, suggesting that they work independently, but we need to continue analyzing the function of each effector to get a clearer picture," says lead author Yoshitaka Takano of KyotoU's Graduate School of Agriculture.

Takano's team used functional analysis, targeted gene disruption, on effector-like genes, which are highly expressed in six isolates of the inoculated pathogen.

"We have just cracked open a peephole to understand how effectors of phytopathogenic fungi shape host specificity. Our growing knowledge may lead to new crop protection technologies."

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Submit the application online (https://hrs.wsu.edu/jobs/).

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COMING EVENTS

Plant Health 2023 – APS Annual Meeting
12 August - 16 August, 2023
Denver, Colorado, USA
Website:
www.apsnet.org/meetings/annual/Pages/default.aspx

12th International Congress of Plant Pathology (ICPP2023)
20 August - 25 August, 2023
Lyon, France
Website: www.icpp2023.org

Plant Pathology 2023
5 September - 8 September, 2023
Birmingham, UK
Website: www.bspp.org.uk/conferences/plant-pathology-2023/

X International Conference "Bioresources and Viruses"
11 September - 13 September, 2023
Kyiv, Ukraine
Website: icbv.knu.ua

24th Australasian Plant Pathology Society Conference
20 November - 24 November, 2023
Adelaide, South Australia
Website: eventstudio.eventsair.com/apps2023/

XX International Plant Protection Congress
1 July - 5 July, 2024
Athens, Greece
Website: www.ippcathens2024.gr

9th ISHS International Postharvest Symposium
11 November – 15 November, 2024
Rotorua, New Zealand
Website: scienceevents.co.nz/postharvest2024

12th INTERNATIONAL CONGRESS ON PLANT PATHOLOGY

ICPP 2023

ONE HEALTH for all plants, crops and trees

LYON

20-25 August, France

ISPP INTERNATIONAL SOCIETY FOR PLANT PATHOLOGY

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